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Study on the Effects of Acupuncture in Alleviating Depression and Social Anxiety Induced by Chronic Pain in Patients

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Abstract: ***Objective:*** *To investigate the efficacy of acupuncture in alleviating chronic pain, explore its relationship with depression and social anxiety in chronic pain patients, and clarify the therapeutic role of acupuncture.* ***Methods:*** *Between 2023 and July 2024, 126 patients were randomly selected from the acupuncture department of a traditional Chinese medicine hospital in Shaanxi Province. Questionnaires comprising the Numerical Rating Scale for Pain, Beck Depression Inventory (BDI), and Interpersonal Anxiety Scale (IAS) were administered.* ***Results:*** *Chronic pain severity positively correlated with depression ($r = 0.218$, $P < 0.05$), and depression positively correlated with social anxiety ($r = 0.511$, $P < 0.05$).The severity of chronic pain influenced an individual's depression status (adjusted $R^2 = 0.04$, $\beta = 1.039$), while depression scores affected an individual's social anxiety status (adjusted $R^2 = 0.225$, $\beta = 0.404$).Follow-up assessments indicated acupuncture's impact on chronic pain, depression, and social anxiety, with the most pronounced effect on chronic pain and the least evident on social anxiety (chronic pain P=0.012, depression scores P=0.032, social anxiety P=0.046).* ***Conclusion:*** *Individuals with higher levels of chronic pain exhibited more severe depressive symptoms, and those with more severe depression also scored higher on social anxiety measures. Acupuncture treatment produced significant improvements in chronic pain, and as pain conditions improved during this process, patients' depression and social anxiety also showed some degree of improvement.*

Keywords: Acupuncture therapy, Chronic pain, Depression, Social anxiety.

1. Introduction

Pain is a complex psycho-physiological experience involving sensory, emotional, cognitive and social components. It is a problem affecting all age groups, with a monthly prevalence ranging from 1% to 60%. Compared to other conditions, pain significantly impairs quality of life [1]. Chronic pain not only inflicts physical suffering but also causes cognitive impairment, emotional disturbances and other adverse effects.

Chronic pain exacerbates psychological distress, inducing varying degrees of tension, anxiety, depression, and other adverse emotional states [2]. Mental health survey data from 17 countries [3] indicates emotional disorders rank as the second most prevalent condition associated with chronic pain. Concurrently, research [4] reveals emotional wellbeing plays a pivotal role in the onset and progression of chronic pain. This reciprocal interaction between chronic pain and emotional disorders [5] leads to diminished quality of life.

Currently, at least 320 million people worldwide suffer from chronic pain. These patients often experience comorbid emotional disorders such as sleep disturbances, anxiety, and depression, which severely impact their quality of life. Epidemiological studies by Matthew Bair et al. indicate that in pain clinics, the average prevalence of major depressive disorder among chronic pain patients is 52%, while in primary care settings, the average prevalence of pain among individuals with depression is 65% [6].

Pain and depression frequently co-occur and mutually influence each other. Chronic pain can induce various physical and psychological tensions, increasing the risk of developing depression. Conversely, pain symptoms are predominant among the physical manifestations associated with depressive disorders. Although antidepressants and analgesics are clinically employed to treat patients with co-occurring chronic pain and depression, only 40% to 60% of patients experience relief from both pain and depression.

Recent electrophysiological and neuroimaging studies [7] have revealed that, compared to sham acupuncture, acupuncture improves pain by restoring connectivity balance in brain regions associated with executive control and pain modulation, preventing cortical thinning, and preventing changes in attention and memory related to pain. It can also regulate mood disorders induced by chronic pain [8]. However, reports on the co-occurrence of acupuncture - induced pain and depression remain scarce, particularly studies examining acupuncture treatment for depression and social anxiety in chronic pain populations. Based on this, the present study focuses on chronic pain patients to understand their mental health status, examining the relationship between chronic pain, depression, and social anxiety, and investigating the therapeutic role of acupuncture. This aims to provide robust evidence for acupuncture's efficacy in alleviating depression and social anxiety in chronic pain populations.

2. Methods

2.1 General Data

Chronic pain patients attending the Acupuncture and Tuina Department outpatient clinic at the Second Affiliated Hospital of Shaanxi University of Traditional Chinese Medicine between December 2023 and July 2024 were enrolled. Inclusion criteria: (1) Meeting the International Association for the Study of Pain (IASP) diagnostic criteria for chronic pain, defined as pain duration exceeding three months, Visual Analogue Scale (VAS) score ≥3, and daily or near-daily pain occurrence; (2) Educational attainment at secondary school level or above, with voluntary participation in the study; (3)

Age range between 18 and 80 years. Exclusion criteria: (1) Presence of malignant tumours or severe cardiovascular, hepatic, renal, or neurological disorders; (2) History of neurologically or psychiatrically diagnosed organic brain disorders (e.g., cerebral infarction) or major psychiatric illnesses (e.g., schizophrenia); (3) Intellectual disability.

2.2 Research Tools

1) General Information Questionnaire: A self-designed questionnaire covering gender, age, educational attainment, marital status, and presence of chronic pain. Chronic pain was defined as persistent or recurrent pain lasting over three months.

2) Numerical Rating Scale for Pain [9] (NRS) This scale assesses chronic pain severity in older adults, comprising 11 numerical values from 0 to 10, where higher numbers indicate greater pain intensity. Participants without chronic pain were assigned an NRS score of 0.

3) Beck Depression Inventory [10] (BDI) This widely used questionnaire assesses the severity of each depressive symptom. The 21-item scale employs a four-point rating scale (0–3 points), with the total score being the sum of all 21 items. Depression severity is categorised as follows: No depression or very mild (≤4 points); Mild depression (5–13 points); Moderate depression (14–20 points); Severe depression (≥21 points).

4) Interaction Anxiousness Scale (IAS) [11] assesses the tendency towards subjective social anxiety experiences independent of observable behaviour. The IAS comprises 15 self-report items rated on a five-point scale (1: Does not describe me at all; 5: Describes me perfectly). Items were selected based on two criteria: (a) They pertain to subjective anxiety (tension and neuroticism) or its opposite (relaxation, calmness), without involving specific external behaviours. (b) Items predominantly concerned unexpected social situations where an individual's response depends on or is influenced by the reactions of others present (as opposed to, for example, public speaking situations). The scale underwent four phases of refinement, reducing the initial 87 items to the current 15. The total score ranges from 15 (lowest level of social anxiety) to 75 (highest level of social anxiety).

3. Results

3.1 Basic Characteristics of Study Subjects

A total of 126 outpatients were surveyed, comprising 58 males (46.1%) and 68 females (53.9%); 63 cases (50%) were under 30 years old, 42 cases (33.33%) were aged 30–49, 20 cases (15.87%) were aged 50–69, and 1 case (0.79%) was over 70 years old; Educational attainment: 4 subjects (3.17%) had primary school education, 5 (3.96%) had junior secondary education, 14 (11.11%) had senior secondary education, 28 (22.22%) had college education, and 75 (59.52%) had undergraduate or higher qualifications. 76 subjects reported recent chronic pain, while 50 reported no pain.

3.2 Analysis of Differences Among Study Subjects Under Various Characteristics

1) Regarding depression scores: no significant differences were observed between genders, age groups, or residential statuses; however, statistically significant differences were noted across educational attainment levels. See Figure 1.

2) Regarding social anxiety scores: no significant differences were observed between genders; statistically significant differences were found across age groups; no significant differences were observed between residential statuses; no significant differences were observed between educational attainment levels.

3) Regarding pain status: no significant difference was observed between genders; statistically significant differences were found across age groups and residential circumstances; no significant difference was observed across educational attainment levels. See Table 1.

3.3 Correlation Analysis

Results indicate that within the sample cohort presenting for treatment, depression exhibits a positive correlation with chronic pain ($r=0.218$, $P<0.05$) and social anxiety ($r=0.511$, $P<0.05$). The relationship between chronic pain and social anxiety is not statistically significant. Acupuncture session frequency shows a positive correlation with pain, but no significant association with depression or social anxiety. See Table 2.

Table 1: Analysis of Differences Among Study Participants by Characteristic (n=126)

Category	Item	n(%)	Depression		Social Anxiety		Pain	
			Score	P-value	Score	P-value	Score	P-value
Gender	Male	58	28.22	0.322	36.69	0.802	3.83	0.295
	Female	68	26.38		37.06		4.24	
Age	<30	63	28.24	0.72	39.03	0.029	3.32	0.001
	30-49	42	26.57		34.88		4.69	
	50-69	20	25.6		34.65		4.85	
	>70	1	24		31		7	
Living Situation	Living with Family	83	27.42	0.753	35.88	0.053	4.58	0.001
	Living Alone	13	29.23		35.23		2.54	
	Living with Friends or Roommates	28	26.04		40.61		3.21	
	Other Situations	2	23		37.5		3.5	
Education Level	Primary School and Below	4	23	0.004	29.75	0.115	2	0.085
	Middle School	5	23.8		32.8		5.6	
	High School/Vocational	14	34.86		40.36		4.71	
	College	28	30.43		37.89		3.71	
	Bachelor's Degree and Above	75	25.07		36.52		4.05	

Table 2: Correlation Analysis of Depression, Social Anxiety, and Pain in Acupuncture Patients

		Total Depression Score	Frequency	Total Social Score	Pain Score
Total Depression Score	Pearson correlation	1			
	two-tailed p-value				
Frequency	Pearson correlation	0.168	1		
	two-tailed p-value	0.06			
Total Social Score	Pearson correlation	.511**	0.031	1	
	two-tailed p-value	0	0.726		
Pain Score	Pearson correlation	.218*	.247**	0.067	1
	two-tailed p-value	0.014	0.005	0.453	

Table 3: Regression analysis of pain intensity on depression scores

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	β	s_x	Beta			Tolerance	VIF
	23.025	1.92		11.991	0		
Pain Score	1.039	0.419	0.218	2.482	0.014	1	1
Total Depression			R=0.218 R^2=0.047 Adjust R^2=0.04				

Table 4: Regression analysis of depression scores on social anxiety scores

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	β	s_x	Beta			Tolerance	β
	25.895	1.778		14.566	0		
Total Depression	0.404	0.061	0.511	6.613	0	1	1
Total Social Score			R=0.511 R^2=0.261 Adjust R^2=0.255				

Table 5: Comparison of scores before and after assessment

Category	Item	n(%)	Depression		Social Anxiety		Pain	
			Score	P-value	Score	P-value	Score	P-value
Acupuncture Treatment	Pre-treatment	66	25.924	0.032	36.5	0.046	3.697	0.012
Comparison	Post-treatment	66	23.485		34.333		2.788	

3.4 Regression Analysis

1) Regression analysis of pain intensity on depression scores

Results indicate that regression analysis of pain intensity on depression scores (*adjusted* R^2= 0.04, β = 1.039) demonstrates pain intensity's explanatory power for depression: higher individual pain intensity correlates with higher depression scores. See Table 3.

2) Regression analysis of depression on social anxiety

Results indicate that regression analysis of depression scores on social anxiety scores (*adjusted* R^2= 0.225, β = 0.404) demonstrates depression significantly explains individuals' social anxiety levels, with higher depression scores correlating with more severe social anxiety. See Table 4.

3.5 Comparison of Scores After Acupuncture Treatment

Results indicate statistically significant reductions in chronic pain, depression, and social anxiety scores before and after treatment ($P < 0.05$). See Table 5

4. Discussion

Acupuncture not only alleviates patients' pain but also regulates their emotional wellbeing to a certain extent. The interplay between physiological and psychological effects in acupuncture therapy remains challenging for modern medicine to achieve simultaneously, representing another advantage of acupuncture analgesia beyond its high safety profile. Although extant ancient Chinese texts contain no dedicated treatises on the comorbidity of depression and pain, recognition of this phenomenon dates back centuries. The Suwen: Great Treatise on Yin-Yang Correspondences posits that "pain arises from qi injury". Zhang Zihe of the Jin Dynasty stated in Confucian Medical Treatise: "All pains originate from qi." The normal circulation of qi and blood within the meridians relies on qi's propulsive force; when qi movement is obstructed, the meridians become blocked, and blockage leads to pain. Both qi stagnation and qi obstruction can cause pain [12]. The Spiritual Pivot: The Essence of the Spirit states: "Those afflicted by sorrow experience qi closure and stagnation." The Comprehensive Medical Compendium of Ancient and Modern Times, in its section on Depressive Disorders, states: "Depression arises from the seven emotions being unsettled, leading to stagnation. When prolonged, it manifests in myriad pathological transformations." Traditional Chinese Medicine classifies depression as a "depressive disorder," originating from the liver's failure to regulate and disperse qi properly. Its fundamental pathogenesis is qi stagnation, making qi stagnation the shared TCM pathogenesis underlying both depression and pain. Furthermore, individuals with depression exhibit deficient yang qi, suppressed qi movement, and impaired qi transformation within the zang-fu organs [13]. This disrupts the normal ascending and descending transport of body fluids, leading to inadequate nourishment of the zang-fu organs, meridians, limbs, and joints. Consequently, "insufficient nourishment results in pain" [14]. Analysing this from the perspective of TCM pathogenesis reveals that depression and pain mutually influence each other and are closely intertwined.

This study collected data from 76 patients reporting pain experiences and 50 patients with past but no current pain experiences, with pain prevalence accounting for 60.3% of participants. This rate significantly exceeds the 24.6% prevalence reported by German researchers in a survey of chronic pain patients [15] and the 34.19% prevalence identified by Hong Kong scholars through telephone surveys in the region [16]. This discrepancy may partly stem from the targeted nature of this study's population, and partly from

differences in sample size compared to the large-scale population surveys in the aforementioned studies. Additionally, within this survey, 35 patients (27.8%) had not previously undergone acupuncture treatment; 85 patients (67.5%) had received acupuncture treatment; and 6 patients (4.8%) had undergone other treatments. Consequently, this data effectively illustrates the role acupuncture plays in chronic pain management.

Differential analysis across demographic characteristics revealed significant variations in depression scores across educational attainment levels, with the highest mean score observed among those with college qualifications. This aligns with findings from a 2020 study by scholars at Beijing Normal University [17], indicating that educational attainment correlates significantly with depression levels, though not in a straightforward linear manner. On one hand, education reduces depression by improving cognitive processes and enhancing socioeconomic status; on the other, depression does indeed become more prevalent among higher-educated groups as educational attainment increases, with the critical threshold being whether higher education has been received. The study also indicates that the impact of education on depression levels is confounded by age effects;

Social anxiety scores exhibit pronounced age-specific variations, particularly within the 30-49 age bracket where levels significantly exceed other age groups. This phenomenon may stem from heightened social demands and pressures within interpersonal relationships characteristic of this demographic.

Chronic pain exhibits pronounced age-related variations, with data trends broadly following a linear pattern of increase with age. This aligns with Falasinnu's findings and is attributed to age-related physical decline and other aetiological factors [18]. Regarding residential circumstances, patients living alone exhibited higher chronic pain scores. This may stem from reduced social support among solitary dwellers. Research by Pei Yingying et al. indicates that robust family functioning can mitigate pain severity and impact by fostering patients' self-management of pain [19].

Regression analysis revealed a significant positive correlation between chronic pain scores and depression scores, indicating that chronic pain severity substantially influences depressive mood. The co-occurrence of chronic pain and depressive mood likely results from multiple interacting factors, including physiological and molecular mechanisms: Brain regions including the nucleus accumbens, amygdala, thalamus, anterior cingulate cortex, and prefrontal cortex collectively modulate the relationship between chronic pain and depression/anxiety [20]. Concurrently, studies indicate that key neurotransmitters in the central nervous system regulating depression and anxiety—such as serotonin and noradrenaline—also influence chronic pain-like behaviours. Depression and anxiety have consistently demonstrated a highly significant correlation in previous studies. On one hand, depression and social anxiety share common mechanisms of action in certain brain regions. On the other hand, functional abnormalities in specific brain regions of individuals with depression can impair social cognitive functions. For instance, amygdala dysfunction may affect an individual's early recognition and mid-stage processing of negative emotions, subsequently manifesting as behavioural characteristics of social anxiety [21].

This study found significant correlations between chronic pain and depression, and between depression and social anxiety. Acupuncture treatment, as a traditional therapeutic approach, demonstrated marked efficacy for both chronic pain and depression, while also exerting an influence on social anxiety. Conversely, the longitudinal study revealed that as treatment sessions increased, patients developed depressive symptoms during the process, which undoubtedly impeded therapeutic progress. This underscores the importance for healthcare professionals to prioritise the emotional characteristics of chronic pain patients in improving their condition. Although subsequent assessments revealed that the mediating pathway of acupuncture sessions on social anxiety operates through depressive mood, demographic analyses indicated that the presence or absence of social support in patients' residential circumstances significantly influences the improvement of chronic pain conditions. This highlights the critical importance of emphasising patients' social support during chronic pain treatment.

This study's innovation lies in its focus on exploring depression and social anxiety among chronic pain patients, providing theoretical grounds for enhancing awareness of their mental health. It demonstrates that acupuncture treatment for chronic pain can improve individuals' psychological well-being. However, the study found no significant effect on the direct pathway between chronic pain and social anxiety, potentially due to the small sample size. Future research may explore constructing partial mediation models linking chronic pain, depression, and social anxiety with larger samples, or incorporate acupuncture session frequency to develop chained mediation models.

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